ESO 1174

COMPARATIVE COSTS OF OVERWINTERING CONTAINER-GROWN NURSERY STOCK

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July 15, 1985

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INTRODUCTION

Practically all plants grown in containers as well as field-grown plants harvested in the autumn for spring sales in U.S.D.A. Plant Hardiness Zones 5 and 6 suffer damage or death if not protected. Costs of overwintering plant material contribute significantly to the expense of producing nursery products in Northern Plant Hardiness Zones. Nurserymen in the Southern region have not traditionally been as concerned about overwintering plants as nurserymen in the Northern regions. However, losses due to death or damage of plants in the Southern Plant Hardiness Zones when not protected can also be considerable.

OBJECTIVES

The objectives of this study, summaries of which are reported in this paper, were to:

1. Model a series of overwintering systems that would accomodate all species of plants being overwintered in U.S.D.A. Plant Hardiness Zones 5, 6, 7, and 8.

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2. Design physical facilities including land areas and structures required to accommodate the identified systems.
3. Develop cost budgets for each of the delineated overwintering systems.

MATERIALS AND METHODS

Data were obtained from wholesale nursery suppliers in the respective areas in 1984. Prices reflect quantities of materials based on container nurseries containing 17 total acres, 350,000 square feet of growing area and 210,000 square feet of overwintering space. Overwintering space included either 156 structureless enclosures, 356 polyhuts, 156 polyhouses, or a combination of the three. It was also assumed that for overwintering, plants would be placed container to container.

Cost budgets did not include ground preparation, graveling, or irrigation fixtures. It was assumed that they should be charged to "grow-on" rather than overwintering costs.

Costs were established for all factors directly attributed to overwintering including management and invested capital. In economic terms input costs associated with factors of production by owner/operators are often referred to as "opportunity costs" or the income the investment would have received if invested elsewhere. For example, owners could be employed as managers at other nurseries, and money invested in land, buildings,

irrigation systems, and equipment could have earned interest elsewhere.

Annual costs are normally divided between fixed and variable costs. Fixed costs are those that would have been incurred by a nursery regardless of the level of production. They include such items as depreciation, interest on investment, taxes, insurance, general overhead, and interest on general overhead. Variable costs, on the other hand, are directly attributed to the level of production. They include items normally consumed during a given years' production such as chemicals or fertilizers.

Differences in overwintering costs were influenced by both the sophistication of the system and in cost estimating. For the same type of system, cost estimates for overhead and hourly labor were the main reasons for higher costs in Zones 5 and 6.

For this study, general overhead for Zones 5 and 6 were assessed by taking the figure $95,025 developed in 1982 for an earlier study (1) using figures for the same sized nursery and inflating it by 10% to $104,527. For Hardiness Zones 7 and 8 the figure $59,286, calculated in 1982 was inflated by 10% to $65,215 (2). Twenty-five percent of these figures ($25,132 for Zones 5 and 6 and $16,304 for Zones 7 and 8) were assigned to overwintering. General overhead costs make up a major portion of a nurseries overwintering fixed costs. These overhead costs can be classified as: utilities, licenses and bonds, advertising and printing, insurance for personnel, travel, professional fees, administrative and management, and miscellaneous.

Structureless systems. Structureless systems incur general overhead plus variable costs. For a 14' x 96' enclosure in Zones 5 and 6 total annual costs ranged from $333.46 where plants are simply consolidated without additional protection, to $534.92 where plants are consolidated and surrounded by bales of straw (Table 1). On a per sq. ft. basis the costs ranged from 25 to 40 cents; per one-gallon container from 8 to 14 cents; per two-gallon container from 15 to 24 cents; and per three-gallon container from 22 to 35 cents (Table 2). In Zones 7 and 8 costs per enclosure ranged from $225.11 to $379.58 (Table 1). On a per sq. ft. basis, costs ranged from 17 to 28 cents; per one-gallon container from 6 to 10 cents; per two-gallon container from 10 to 17 cents; and per three-gallon container from 15 to 25 cents (Table 2).

Polyhut systems. It was estimated that it would cost $120.24 to construct a 6' x 96' polyhut in Zones 5 and 6 and $95.95 in Zones 7 and 8. In Zones 5 and 6 annual fixed costs on a per polyhut basis were estimated at $109.61 and $74.07 for Zones 7 and 8.

Total annual costs of overwintering plants in polyhuts differentiated by Zones are shown in Table 1. In Zones 5 and 6 costs per polyhut ranged from $246.80 where plants were just placed in polyhuts without additional protection to $286.61 where plants were directly covered with both a thermal blanket and one layer of polyethylene (Table 1). On a per sq. ft. basis costs ranged from 43 to 50 cents; per one-gallon container from 15 to

17 cents; per two-gallon container from 25 to 29 cents; and per three-gallon container from 38 to 44 cents (Table 2). In Zones 7 and 8 costs per polyhut were $182.24 (Table 1). On a per sq. ft. basis the cost was 32 cents; per one-gallon container 11 cents; per two-gallon container 19 cents; and per three gallon container 28 cents (Table 2).

Polyhouse - single cover sytems. Construction costs for a 14' x 96' polyhouse covered with a single layer of polyethylene were estimated to be $1,131.58 for Zones 5 and 6 and $1,013.00 for Zones 7 and 8. In Zones 5 and 6 annual fixed costs on a per polyhouse basis were estimated at $487.28 and for Zones 7 and 8 at $387.38.

Total annual costs of overwintering plants in polyhouses covered with a single layer of polyethylene are shown in Table 1. In Zones 5 and 6 they ranged from $751.76 where plants are consolidated within the polyhouse, but with no additional covering, to $815.08 where plants were covered with both a thermal blanket and one layer of polyethylene. On a per sq. ft. basis costs ranged from 56 to 61 cents; per one-gallon container from 22 to 24 cents: per two-gallon container from 38 to 41 cents; and per three-gallon container from 57 to 61 cents (Table 2). In Zones 7 and 8 few nurseries use overwintering protection more sophisticated than a polyhouse covered with a single layer of polyethylene and without additional interior plant protection. Costs for this type of system were $601.55 (Table 1). On a per sq. ft. basis, cost was 45 cents; per one-gallon container 17

cents; for a two-gallon container 30 cents; and per three-gallon container they were 45 cents (Table 2).

Polyhouse - double cover - inflated systems. Construction costs for a 14' x 96' polyhouse covered with air inflated polyethylene were estimated at $1,161.58 for Zones 5 and 6 with annual fixed costs estimated at $495.38. This system is seldom used in Zones 7 and 8 and was not budgeted for those Zones.

Total annual costs for this system for Zones 5 and 6 are delineated in Table 1. They ranged from $812.36 for a system without additional plant covering to $875.68 where plants were directly covered with both a thermal blanket and one layer of polyethylene film. On a per sq. ft. basis, costs ranged from 60 to 65 cents; per one-gallon container from 23 to 25 cents; per two-gallon container from 41 to 44 cents; and per three-gallon container from 61 to 66 cents (Table 2).

Polyhouse - inflated covering - Heated. This was the most sophisticated system budgeted, but is not normally used in Zones 7 and 8 for overwintering. In Zones 5 and 6 estimated construction costs were $1,842.68 for a 14' x 96' polyhouse with annual fixed costs of $650.35.

Total annual costs for this system were $1,238.94 (Table 1). On a per sq. ft. basis, costs were 92 cents; per one-gallon container 36 cents; per two-gallon container 62 cents; and per three-gallon container 93 cents.

SUMMARY

Costs of 18 different overwintering systems were analyzed. Sixteen systems were considered to be used on a regular basis by nurserymen in U.S.D.A. Plant Hardiness Zones 5 and 6, and eight in Zones 7 and 8. Total annual costs per sq. ft. varied from 25 to 92 cents in Zones 5 and 6 and from 17 to 45 cents in Zones 7 and 8. In Zones 5 and 6 they varied from 25 to 40 cents for structureless systems, from 43 to 50 cents in polynuts, from 56 to 61 cents in polyhouses covered a single layer of polyethylene, from 60 to 65 cents in polyhouses covered with air inflated polyethylene, and were 92 cents in a heated, air inflated polyhouse. Total annual sq. ft. costs for Zones 7 and 8 varied from 17 to 28 cents in structureless systems, were 32 cents in polyhuts, and were 45 cents in polyhouses covered with a single layer of polyehtylene. Cost differentials for similar overwintering systems were due primarily to higher overhead and hourly labor costs in Zones 5 and 6 as compared with Zones 7 and 8. In general, overwintering costs varied directly with the degree of protection desired. Most plant species usually require more overwintering protection in northern than in sourthern Hardiness Zones. In some instances it may cost from 50 to 100% more to overwinter a plant in Zone 5 and 6 as compared with Zones 7 and 8.

IMPLICATIONS

If the cost of consolidating plants in a structureless system is considered the simplest and least expensive system, the costs that were generated will allow the nurseryman to analyze costs required for further protection. The basis includes the portion of overwintering overhead as well as direct costs associated with the simplest system. For example, the basic cost of overwintering a one-gallon container in Zones 5 and 6 would be 8 cents. One further method of analysis would determine the added costs of going from the simplest system to each of the more sophisticated classifications. To go from the basis, in Zones 5 and 6, to a polyhut would cost an additional 7 cents per one-gallon container; to a single layer polyhouse, 14 cents; to an air inflated polyhouse, 15 cents; to an air inflated and heated polyhouse, 28 cents. Starting with the simplest system (no additional covering of plants) in a classification, it would cost from 1 to 2 cents more per one-gallon container to cover plants with polyethylene, and an additional 1 to 2 cents to add a thermal blanket. While it was fairly expensive to add protection by moving up to a more sophisticated classification (exception would be going from a single layer to an air inflated polyhouse), it was relatively inexpensive to add protection within a classification by covering plants directly with either last years' polyethylene, a thermal blanket, or both. It should also be noted that all costs were based on container to container placement for overwintering. This is not always possible for all

plant types, particularly older, or larger plants. Where plant to plant placement is used more space will be required, hence costs will also be higher.

LITERATURE CITED

1. Badenhop, M.B. and T.D. Phillips. 1983. Costs of Producing and Marketing Container-Grown Woody Landscape Plants: The Pfitzer Juniper. Southern Coop. Ser. Bull 299.
2. Taylor, Reed D., Harold H. Kneen, David E. Hahn and Elton M. Smith. 1983. Costs of Establishing and Operating Container Nurseries Differentiated by Size of Firm and Species of Plant in U.S.D.A. Climatic Zone Six. Southern Coop. Series Bull. 301.

TABLE 1.--Summary of Annual Total Costs (Dollars) of Overwintering Nursery Plants Differentiated by System and U.S.D.A. Plant Hardiness Zone.

System	U.S.D.A. Plant Hardiness Zone 5 & 6	7 & 8
Structure less (14′ x 96′)		
1. Plants consolidated - no covering or wrapping	333.46	225.11
2. Plants consolidated - surrounded with lined craft paper	N/A	238.76
3. Plants consolidated - surrounded with bales of straw	534.92	379.58
4. Plants consolidated - covered with one layer of poly film	405.27	291.11
5. Plants consolidated - covered with thermal blanket	N/A	291.65
6. Plants consolidated - covered with thermal blanket and poly	447.30	331.21
Polyhut (6′ x 96′)		
7. No plant covering	246.80	182.24
8. Plants covered with 1 layer poly film	267.98	N/A
9. Plants covered with thermal blanket	286.61	N/A

Table 1 Cont.

	Polyhouse - Single Cover (14' x 96')	
10. No plant covering	751.76	601.55
11. Plants covered with poly film	773.05	N/A
12. Plants covered with thermal blanket	807.98	N/A
13. Plants covered with thermal blanket and poly film	815.08	N/A
	Polyhouse - Double Cover - Inflated (14' x 96')	
14. No plant covering	812.36	N/A
15. Plants covered with poly film	833.65	N/A
16. Plants covered with thermal blanket	868.59	N/A
17. Plants covered with thermal blanket and poly film	875.68	N/A
	Polyhouse - Double Cover - Inflated and Heated (14' x 96')	
18. No plant covering - Polyhouse heated	1,238.94	N/A

TABLE 2.--Summary of Total Annual Costs (Cents) of Overwintering Nursery Plants Differentiated by System, U.S.D.A. Plant Hardiness Zone, Square Foot and Container Size

System	U.S.D.A. Plant Hardiness Zone							
	5 & 6				7 & 8			
		Costs per container				Costs per container		
	Sq. Ft.	1-gal.	2-gal.	3-gal.	Sq. Ft.	1-gal.	2-gal.	3-gal.
Structure less (14' x 96')*								
1. Plants consolidated - no cover or wrapping	25	8	15	22	17	6	10	15
2. Plants consolidated - surrounded with lined Kraft paper	N/A	N/A	N/A	N/A	18	6	11	16
3. Plants consolidated - surrounded with bales of straw	40	14	24	35	28	10	17	25
4. Plants consolidated - covered with one layer poly film	30	10	18	27	22	7	13	19
5. Plants consolidated - covered with thermal blanket	N/A	N/A	N/A	N/A	22	7	13	19
6. Plants consolidated - covered with thermal blanket and poly	33	11	20	30	25	8	15	22

Table 2 Cont.

Polyhut (6′ x 96′)**								
7. No plant covering	43	15	25	38	32	11	19	28
8. Plants covered with 1 layer poly film	47	16	28	41	N/A	N/A	N/A	N/A
9. Plants covered with thermal blanket	50	17	29	44	N/A	N/A	N/A	N/A
Polyhouse - Single Cover (14′ x 96′)								
10. No plant covering	56	22	38	57	45	17	30	45
11. Plants covered with poly film	58	22	39	58	N/A	N/A	N/A	N/A
12. Plants covered with thermal blanket	60	23	40	61	N/A	N/A	N/A	N/A
13. Plants covered with thermal blanket and poly film	61	24	41	61	N/A	N/A	N/A	N/A
Polyhouse - Double Cover - Inflated (14′ x 96′)								
14. No plant covering	60	23	41	61	N/A	N/A	N/A	N/A
15. Plants covered with poly film	62	24	42	63	N/A	N/A	N/A	N/A
16. Plants covered with thermal blanket	65	25	43	65	N/A	N/A	N/A	N/A
17. Plants covered with thermal blanket and poly film	65	25	44	66	N/A	N/A	N/A	N/A
Polyhouse - Double Cover - Inflated and Heated (14′ x 96′)								
18. No plant covering - Polyhouse heated	92	36	62	93	N/A	N/A	N/A	N/A

*A 14′ x 96′ enclosure equals 1344 sq. ft. and would accomodate 3926 1-gal. containers, 2270 2-gal., and 1510 3-gal.

**A 6′ x 96′ polyhut equals 576 sq. ft. and would accomodate 1682 1-gal. containers, 972 2-gal., and 647 3-gal.

***A 14′ x 96′ polyhouse equals 1344 sq. ft. and would accomodate 3460 1-gal. containers, 2000 20 gal., and 1330 3-gal. Polyhouses would have a two foot aisle down the center and therefore would not hold as many containers as a container to container enclosure.